Claims

1. A multi-path torque coupling comprising:

an input shaft adapted to be connected to a source of torque;

an output shaft from which torque is delivered, said input shaft and said output shaft having a common axis of rotation;

a wet-plate clutch having first and second clutch members capable of rotating at different angular velocities, said wet-plate clutch configured for transferring torque between said first and second clutch members when said first and second clutch members rotate at different angular velocities, said first clutch member being connected to said input shaft;

a pumping mechanism configured to engage said first and second clutch members of said wet-plate clutch when said first and second clutch members rotate at different angular velocities;

a planetary set including first, second, third, and fourth elements organized about said common axis of rotation, said first element connected to said first clutch member and to said input shaft, said second element connected to said second clutch member, said third element connected to said output shaft, and said fourth element connected between said first element and said second element, and between said second element and said third element;

wherein said input shaft, said wet-plate clutch, said second element, said third element, said fourth element, and said output shaft define a first torque path through said multi-path torque coupling; and

wherein said input shaft, said first element, said third element, said fourth element, and said output shaft define a second torque path through said multi-path torque coupling.

2. The combination according to Claim 1 wherein said pumping mechanism is a gear pump, said pumping mechanism including an external gear coupled to said second clutch member and an internal gear coupled to said input shaft.

3. The combination according to Claim 1 wherein said pumping mechanism is a piston pump, said pumping mechanism including an axial cam plate coupled to said second clutch member and a piston pump disposed within a pump housing, said piston pump in operative relationship to said axial cam plate.

4. The combination according to Claim 1 wherein said first element is a ring element located around said common axis; wherein said second element is a sun element which rotates about said common axis; wherein said third element is a carrier element which rotates about said common axis; and wherein said fourth element is a planetary element located between, and engaged with, said sun and said ring elements, said planetary elements disposed on said carrier element.

5. The combination according to Claim 1 further including a locking mechanism configured to maximize torque transfer between said input shaft and said output shaft.

6. The combination according to Claim 5 wherein said locking mechanism consists of a roller controlled bi-directional clutch.

7. The combination according to Claim 5 wherein said locking mechanism consists of a sprag controlled bi-directional clutch.

8. The combination according to Claim 5 wherein said locking mechanism consists of a strut controlled bi-directional clutch.

9. The combination according to Claim 5 wherein said locking mechanism is operatively disposed in parallel with said wet-plate clutch, between said first and second elements of said planetary set.

10. The combination according to Claim 5 wherein said locking mechanism is operatively disposed between said first and third elements of said planetary set.

11. The combination according to Claim 5 wherein said locking mechanism is operatively disposed between said second and third elements of said planetary set.

12. A torque coupling comprising:

an input shaft adapted to be connected to a source of torque;

an output shaft from which torque is delivered;

a clutch having first and second clutch members capable of rotating at different angular velocities, said clutch configured for transferring torque between said first and second clutch members when said first and second clutch members rotate at different angular velocities, said first clutch member being connected to said input shaft;

a locking mechanism configured to maximize torque transfer between said input shaft and said output shaft;

a planetary set including first, second, third, and fourth elements organized about a common axis of rotation, said first element connected to said first clutch member and to said input shaft, said second element connected to said second clutch member, said third element connected to said output shaft, and said fourth element connected between said first element and said second element, and between said second element and said third element.

13. The torque coupling of Claim 12 wherein said locking mechanism is further configured to lock said first element and said second element about said common axis of rotation.

14. The torque coupling of Claim 12 wherein said locking mechanism is further configured to lock said first element and said third element about said common axis of rotation.

15. The torque coupling of Claim 12 wherein said locking mechanism is further configured to lock said second element and said third element about said common axis of rotation.

16. In an automotive vehicle having primary and secondary wheels, a power unit connected directly to the primary wheels, and a torque coupling connected between the power unit and the secondary wheels for apportioning torque between the primary and secondary wheels, said torque coupling comprising:

a clutch, a locking mechanism, and a planetary set connected such that a locking mechanical path and a clutch path exist through which torque is transferred between the power unit and the secondary wheels, with the amount of torque transferred through the clutch path in relation to the amount transferred through the locking mechanical path being variable by the clutch, whereby the apportionment of torque between the primary and secondary wheels is controlled by the clutch and the locking mechanism.